

all who read it will find it delightful. It is full of information about men and matters, an epitome in non-technical language of that part of the history of our own times in which Sir Henry has played a distinguished part. It is enlivened with many good stories, especially of his great master and lifelong friend Baron Bunsen, and adorned with many excellent portraits of the scientific giants of the nineteenth century. Though written, as we have said, for the use of his family in the first instance, this book of memories is essentially a public document, a record of many matters, not commonly known, during an important period. For details of these the book itself must be consulted, since a mere enumeration of the names of those with whom its author has worked in public affairs, or a list of the debates, scientific, educational, industrial and political, in which he has taken part would overcrowd the space available for this notice. In its pages will be found records of student life in Germany in the distant days when it was scarcely possible, or at any rate very difficult, to become a chemist in any other country; stories about University College in the heyday of its youth, when De Morgan, Sharpey, Graham, Liston, and others of equal eminence were among the professors, and Lister, Farrer-Herschell, Bagehot, Jessel, Hutton, Henry Thompson, and Edward Fry were, or recently had been, among its students; much about the early history of Owens College, which, when Roscoe joined the staff, could boast only of thirty-five students, of whom but fifteen were at work in the laboratory, and of the gradual growth of the college in size and dignity until it became the first of the new English universities; a rich mine of information about the progress of technical education from the year 1883, when a Royal Commission consisting of "Mr. Bernhard Samuelson, Mr. John Slagg, Mr. (now Sir) Swire Smith, Mr. (now Sir) Philip Magnus, Mr. William Woodall, and Sir Henry Roscoe" was appointed to study and report on the then state of technical education at home and abroad, and, again, about the recent history of the University of London, of which Sir Henry was for some time Vice-Chancellor, and many other important matters. The book closes, as such a book should, with a few pages which give us a glimpse of the life of Sir Henry and Lady Roscoe at Woodcote Lodge, their Surrey home.

Apart from his scientific work, and the part he took in founding Owens College, Sir Henry Roscoe's share in the labours of the Royal Commission on Technical Instruction and his subsequent labours on behalf of technical and secondary education represent the great feature in his public life. Sir Henry and his colleagues not only spent many months travelling in this country and all over Europe for the public good, but they did this at their own expense; and, after their report was published, many of them spared neither time nor trouble in spreading abroad the knowledge they had acquired of what was being done by our competitors in other countries. One trembles to think what might still be the state of technical education in this country but for them and their

unstinted labours. We should like to quote a few passages from this part of the book, but want of space makes this impossible. But there is one side of the matter to which attention may well be directed at this moment, when the question of national defence, or some part of it, goes daily into the pot, and daily comes out of it again.

It has often been said that the success of the Germans in the Franco-German War depended on the German schoolmaster. After the war this opinion found voice also in France, and Sir Henry illustrates this by telling us that at Rouen he saw, to his surprise, in the school museum a Prussian soldier's helmet. On asking why this was there, he was told by the director that when the scholars did not attend to their work it was his custom to bring this helmet down, put it on the desk, and say, "Now, if you do not make progress and learn properly this will happen to you again. The surest way to bring it upon you is to neglect your studies and grow up in ignorance, and become inferior in intellectual training." "The display of this helmet," said the director, "never fails to bring the blush of shame to the cheeks of my students, and to rouse their patriotism and their zeal for their studies." May we recommend this story to the attention of Mr. Haldane, and still more to that of the Minister for Education, and to politicians in general, and suggest that it has for us in England a moral also? Only here, alas! the men need to learn the lesson it conveys as well as, and, indeed, even more than, the boys.

We cannot conclude without expressing our admiration of Lady Roscoe's contribution to this charming volume, viz. the excellent reproduction of her photograph "The Fisherman," which was recently pronounced, by a very competent authority, to be the best photograph by an English amateur that they could suggest for insertion in an American journal, and our hearty wish that Sir Henry and Lady Roscoe may long remain among us to enjoy their retreat in sunny Woodcote, where the great chemist has crowned his scientific career by the almost unique achievement of making both ends meet as an amateur farmer.

W. A. S.

#### WITH WIRES AND WITHOUT.

*Telegraphy.* By T. E. Herbert. Pp. xx+912. (London: Whittaker and Co., 1906.) Price 6s. 6d. net.

*The Principles of Electric Wave Telegraphy.* By Dr. J. A. Fleming. Pp. xix+671. (London: Longmans, Green and Co., 1906.) Price 24s. net.

*Wireless Telegraphy.* By Dr. Gustav Eichorn. Pp. x+116. (London: Charles Griffin and Co., Ltd., 1906.) Price 8s. 6d. net.

*Wireless Telegraphy.* By W. J. White. Pp. x+173. (London: T. C. and E. C. Jack, 1906.) Price 1s. net.

OF the numerous achievements of which the electrical engineer can boast, telegraphy is the one of which he has the greatest reason to be proud. If we combine with telegraphy the sister subject of

telephony there can be little doubt but that by the application of these two sciences he has effected a greater revolution in human affairs than by all his successes in the way of heavy engineering. He may "electrify" our railways, especially the suburban lines, to the great advantage of both the travelling public and the shareholder, but he is still only doing for us in another way what the mechanical engineer has already accomplished. He may harness the great waterfalls and transmit their power over hundreds of miles to localities at which it can be more easily utilised, but he is only saving Mahomet the trouble of going to the mountain. He may provide for us in the arc lamp and the glow lamp the most efficient means of producing artificial light, but he is only supplying us with an alternative to the cheaper productions of the gas engineers. But with telegraphy he has given us something entirely new—an art which, whilst actually annihilating distance, virtually annihilates time. So familiar have we become with the operations of the telegraphist that few probably ever realise how closely dependent upon them is every detail of modern civilised life. We speak of the twentieth century as being, or as promising to be, the electrical age, and we think of the railways, the lighting, and the development of power, whereas in reality it is the electrical age because of the telegraph and the telephone. If the vast network of thin wires which stretch over the civilised world like the threads of a spider's web were suddenly wiped out to-morrow, we should as suddenly realise with the non-appearance of the morning paper what it meant to be thrown back into the age before electricity.

In spite of the enormous influence which telegraphy exercises in our daily life, we hear a great deal less about it than we do of a number of unimportant things. Few people write papers upon it. The *Journal of the Institution of Electrical Engineers*, originally the *Society of Telegraph Engineers*, will be found almost free from such papers during the past ten years. Fewer people write books. The reason is not far to seek. Every applied science passes through three stages—the stages of incubation, of growth, and of maturity. In the first stage the outsider hears little about it; some few who are specially interested in scientific research may be aware that some observations of the natural philosopher are being developed along lines that promise results of great practical utility. At length a point is reached when the practical value of the work becomes so self-evident that even the halfpenny paper realises it, and the world is provided with a new nine-days' wonder. From now begins the period of growth during which publicity is excessive. Everyone talks about the new discovery. Everyone who can makes experiments in connection with it, and publishes his results in papers, and those who cannot afford the time to experiment write books on the subject. After a period more or less protracted public interest wanes, and is diverted, we will say, to a scandal of tinned meat, and, what is more important, the science, from being experimental and much talked of, becomes practical and much used.

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In the art of telegraphy we see a science which reached, long ago, the last stage. If anyone wishes for a general idea of the extent of telegraphy at the present day let him read Mr. Herbert's book. Unless he is an expert, or studying to become one, he will probably realise more from the style in which the book is written than from the study of it in detail. He will see that here he is dealing with something which is firmly established, in which methods and apparatus have become almost stereotyped, and in which progress can only be exceedingly slow because everything is already so highly developed and because the interests which are vested in the methods now in use are so gigantic that only a revolution can warrant their overthrow. Mr. Herbert's book is full and concise, and a vast amount of information is condensed into its pages. At the same time it is simple, as befits a book intended for young students and dealing with a subject in which simplicity has been reached through complexity.

In the three books on wireless telegraphy before us we see good illustrations of what has been said above of the stage of growth of an applied science. Mr. White's book is a somewhat belated arrival, belonging properly to a few years back. It is purely descriptive, almost purely popular, and should have been written when the general public had a keen and living interest in the subject. Inasmuch as it describes the latest systems it has a certain claim to existence. But wireless telegraphy has almost reached the third stage, and before long we shall cease to hear anything more about it, and, taking it for granted, will concern ourselves only with grumbling at its cost. That it has not fully reached the final stages is sufficiently shown by Dr. Fleming's and Dr. Eichorn's books. Of Dr. Eichorn's book we can only say that we should have greatly welcomed its appearance had it not been for the almost simultaneous publication of Dr. Fleming's work. Dr. Eichorn was manager of the large experimental stations for Prof. Braun, and writes specially about the systems which have been developed by Slaby, Arco and Braun into the "Telefunken" system, which shares, we suppose, with the Marconi system the honour of being the most important and most practical systems yet developed. The book is well written, and combines with a good deal of description a careful investigation of the fundamental theoretical phenomena.

But in Dr. Fleming's book we have undoubtedly the one to be recommended to students specially interested in wireless telegraphy, and the practical development already attained warrants the existence of a certain number of such students. If technical education were organised in an ideal manner there would exist a professorial board the duties of which would be to prescribe exactly the literature which a student should and should not read. Such a body would allow anyone to write and publish books, and would not prohibit reading them until the tentative efforts of various authors resulted in the production of one or more books containing all the information on the subject which could be regarded as necessary and sufficient. Then they would say to the student:

You may read this and that book, but on no account are you to waste any time on any others; you may consult such and such original researches, but the remainder are useless. We have no doubt that this body would notify in the present instance that the student of wireless telegraphy must confine his attention to the books by Hertz and Dr. Fleming. We are not speaking of the student of electromagnetic waves. In Dr. Fleming's book is to be found a treatment of the subject which is exhaustive and thorough both on the theoretical and practical sides. It is a book which has been long wanted, and will be warmly welcomed.

One may notice, however, by a careful study of the book that wireless telegraphy practice is still to a certain extent tentative. The *best* methods are not yet decided upon, and methods differ because there is still much ignorance. But there are signs that the approach to more exact results is being made with the advent of apparatus based on wider knowledge and capable of allowing accurate measurements. Just as telegraphy needed the development of very special apparatus before full advantage could be taken of its powers, so wireless telegraphy calls for its own special apparatus. The process of development is necessarily slow, but in our present state of technical attainments it is sure.

It is quite evident from the perusal of the books before us that there is room in our complex civilisation both for ordinary telegraphy and wireless telegraphy. There are very few new discoveries which succeed in displacing old ones. We have room for many technical developments, and are capable of using all to their best advantages in the spheres for which they are particularly suited. For telegraphy over land there is little, if any, fear that wires will be displaced. There is little fear either that for communication between continent and continent the cable will give way to the overgrown "antennæ." Wireless telegraphy has found its special sphere in communication with ships, and soon will succeed in bringing us as close together at sea as we now are on land. When we consider that any man in any civilised country will be able to get into almost instant communication with any other, either on land or sea, we can realise something of the benefits conferred by telegraphy with wires and without.

MAURICE SOLOMON.

#### THEORETICAL BIOLOGY.

*Les Problèmes de la Vie.* Part iii. La Fécondation et l'Hérédité. By Prof. Ermanno Giglio-Tos, 1905. Pp. vii+189. Part ii. L'Ontogénèse et ses Problèmes. 1903. Pp. 368; 36 figures. (Chez l'Auteur à l'Université de Cagliari.)

IN the third volume of his treatise on the problems of life, Prof. Giglio-Tos proposes to elucidate all the puzzling problems of maturation, fertilisation, and heredity in the light of a fundamental phenomenon which he calls "biomolecular addition." Biologists, he tells us, have been too much preoccupied with the interpretation of particular chapters

in the history of the germ-cells, and have neglected to inquire into the fundamental cause which unifies the whole. They have reached partial interpretations, usually "artificial and teleological," of details, but a connected general theory is lacking. They have been like geologists interpreting the course of a river, and ignoring gravitation. The unifying secret is "biomolecular addition," which seems to mean the power that the living molecule (whatever that may be) has of adding to itself another molecule "so that the biomolecule resulting from the addition has double the number of atoms, and may, in consequence, divide into two biomolecules similar to one or the other of the added biomolecules." Thus a male biomolecule and a female biomolecule (identified with paternal and maternal biomolecules) may add together and then divide into two biomolecules which are either male or female. We do not profess to understand this, though the author assures us that biomolecular addition is "nothing but a chemical reaction of the greatest simplicity between the biomolecules constituting the genetic cells," and we regret that we do not understand it, for we are told that "it suffices to explain even in their minor details all the interesting manifestations accompanying the function of sexual reproduction." These are brave words, but the author's "explanation" seems to us far removed from the present-day scope of biology, in Britain at least.

The author cannot accept Weismann's theory of germinal continuity, believing, on the contrary, that the ancestors of the germ-cells become histologically differentiated, like ordinary somatic cells, along special lines of "monodic" development. At a certain epoch—"the genetic moment"—however, they come under the influence of special substances in the internal milieu, and are shunted back on a sort of return journey which brings them, or their descendants rather, to or near their starting point of resemblance to the parental ovum from which they are by cell-lineage derived. If the germ-cells can return perfectly to the state of the original fertilised ovum, with its dual equipment of male and female biomolecules, then parthenogenesis may occur. But this complete return implies very favourable nutritive conditions in the internal milieu, and, as a matter of fact, what usually occurs after the "genetic moment" is a process of internal biomolecular addition as the result of which the male or the female biomolecules in the germ-cells disappear, and two kinds of genetic cells are differentiated (with female or male biomolecules respectively). Thus fertilisation is necessary to restore the integral constitution of the original parental ovum. "The primitive cause of sexuality and of fertilisation is to be found in the phenomenon of biomolecular addition." In a laboriously ingenious fashion the author uses his key to read the mysterious ciphers of maturation and fertilisation, and he finds that it unifies everything—hermaphroditism and parthenogenesis, secondary sex characters, and the rejuvenescence of infusorians. But we have not been able to use his key, and his distinctions between pro-genetic and metagenetic parts of the body, neuter and sexual paragenetic cells, external and internal bio-